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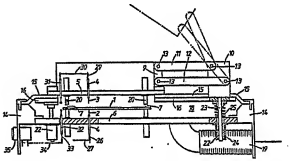
(54) **Electrical interface arrangements.**

(57) An electrical test arrangement has two arrays of conductive probes (2, 3) for contacting the opposite faces of a double sided printed circuit board (1). Both arrays are mounted on the walls (14) of an evacuated chamber, reduction in pressure of which urges the two arrays together so as to sandwich the circuit board between them. One array (2, 3) is mounted in a hinged manner to allow access for the circuit board, and the connection between this array and an electrical input/output port is made via make and break contacts (31, 32) which are operated by the change in pressure which causes movement of the arrays.



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ELECTRICAL INTERFACE ARRANGEMENTS

The invention relates to an electrical interface arrangement in which an array of conductive probes is brought into electrical contact with a circuit board to facilitate the electrical testing of it, and/or of electrical components mounted on the circuit board. As circuit boards, and the components which are mounted upon them, become more complex, greater and greater numbers of conductive probes are required to make contact to all of the circuit nodes which need to be tested. The present invention seeks to provide an electrical interface arrangement in which conductive probes can be used to make contact with both faces of a circuit board.

According to this invention, an electrical interface arrangement for coupling a circuit board to electrical test equipment includes two arrays of conductive probes which are spaced apart from each other and at least one of which is linked to a movable wall portion of an evacuatable chamber, a reduction in pressure of which serves to move the two arrays towards each other so as to sandwich a circuit board between them; and means for making electrical paths between the electrical test equipment and one array of probes which is associated with one surface of the circuit board by action related to said reduction in pressure. In operation one array of conductive probes is movable to a significant extent to allow easy insertion and removal of a circuit board, and

to facilitate this, preferably said one array of conductive probes is mounted on a removable wall portion of the chamber. The provision of means for making and breaking the electrical paths between this array and the input/output port avoids the need for long permanently connected flexible electrical leads to be provided for that array which is temporarily moved aside whilst a circuit board is inserted or removed.

Preferably again, said one array is mounted on a hinged wall portion with respect to a wall portion on which the other array is mounted so that both arrays are aligned with each other when the hinged wall portion is in a first predetermined position. This is not to say that individiaul probes in the two arrays are aligned with each other, as the positions of the probes is determined by the location of the circuit points which are to be contacted and tested, but it is important that both arrays are aligned with the circuit board, and hence with each other.

The use of the two arrays of probes serves to overcome a difficulty which can be experienced when an array of conductive probes is used to make electrical contact with one side of a circuit board in the conventional manner, as the contact force exerted by each probe in order to make a low impedance connection with a circuit board multiplies very rapidly as large numbers of probes are used, causing distortion of what is generally a thin and flexible circuit board. By providing another

array to exert a reaction force on the other side of the circuit board, this difficulty is avoided, and it also enables otherwise inaccessible circuit points to be tested. Double-sided and multilayer circuit boards are now becoming increasingly common, and the use of the two arrays enables both surfaces of a circuit board to be thoroughly tested in a single operation. It not only reduces the testing time, but enables more complex electrical tests to be performed involving nodes and components on both sides of the board simultaneously.

The invention is further described by way of example with reference to the accompanying drawing, which illustrates in a diagramatic fashion an electrical interface arrangement.

A circuit board 1 to be tested is shown mounted within the electrical interface 1 which is illustrated in the drawing. The circuit board may be of the kind commonly termed a printed circuit board in which conductive tracks are formed on one or more sides of a rigid or flexible insulating substrate. Even in the case of a nominally rigid substrate, the board is generally so thin that it has some degree of flexure if its area is of any appreciable size. As the circuits which are required to be formed upon substrates of this kind become increasingly more and more complex, it is becoming more common to fabricate such a circuit as a multilayer circuit board. In such a board of the latter kind, two or more

thin substrates each carrying tracks are bonded together to form a thick composite sandwich. It is extremely difficult to test such a circuit board, especially if it is carrying components on one or both of its outer surfaces, by means of electrically conductive probes which are brought into contact with just one of its surfaces. Thus, in the electrical interface arrangement illustrated in the drawings, two arrays of conductive probes are provided, although only one probe in each array is illustrated for the sake of clarity. Thus, what can be conveniently termed the lower surface of the circuit board 1 is contacted by an exemplary conductive probe 2 and the upper surface can be contacted by an exemplary probe 3. In both cases the probe itself is mounted in a spring-loaded telescopic fashion within a housing 4 which is firmly located within respective apertures in bed plates 5 and 6. The circuit board 1 is supported by four spring-loaded location pins 7 of which only two are visible in the drawing. In practice, one such pin is located in the corner of a circuit board to be tested. The pins 7 are such as to support the circuit board 1 away from the lower bed plate 6 by an amount necessary to give clearance to any components which might be mounted on the lower side of the circuit board 1 and to accommodate of course, the telescopic action of the probes 2.

The upper bed plate 5 is mounted so that it can be moved away from the circuit board 1 to allow access to the

upper surface of the board, and to facilitate its easy insertion and removal. To this end, the bed plate 5 is mounted on a hinge structure consisting of two hinge brackets 9 and 10 which are linked by two rigid couplings 11 and 12, these couplings being pivotally coupled by four pivots 13. The nature of the hinge is such as to allow very good access to the interior of the electrical interface arrangement when the lid is in the raised position, as is indicated diagramatically by the broken lines, and to give a substantially parallel action when the lid is at its closed position.

The two bed plates 5 and 6 form part of an evacuatable chamber, the walls of which are defined by a frame structure 14 which encircles the lower array 2. The bed plate 5 rests upon the upper surface of a flexible apertured diaphragm 15 which in the closed position is sandwiched between it and an upper frame 16. The flexible diaphragm enables a vacuum-tight enclosure to be formed when the upper bed plate is lowered on to it. The upper array of conductive probes 3 is then drawn towards the lower array 2 of conductive probes so as to sandwich the circuit board 1 between them by a suction effect which is achieved by applying a partial vacuum to the enclosure 18 so formed via an extraction port 19.

It will be noted that as the circuit board 1 under test forms no part of the wall of the evacuated chamber, it is of little consequence if it is provided with

apertures e.g. by the omission of components - in a conventional suction apparatus, such apparatus can cause some difficulty. It is to preserve the parallel action of the motion of the upper bed plate 5 when it is drawn towards the lower bed plate 6 under the action of the suction effect, that the special hinge arrangement having the two couplings 11 and 12 is provided. Precise alignment between the two arrays is achieved by means of four spring-loaded posts 20 which co-operate with the upstanding pins 7 when the array 3 is lowered on to the board 1 so as to make contact therewith.

The posts 20 are guided on to the locating pins 7 by the restraining action of four linear bearings 22 which consist each of a shaft 23 which slides within a cylinder 24 mounted on the lower surface of the bed plate 6. Compression springs 25, of which only one is illustrated, serve to force apart the two bed plates 5 and 6 when the suction vacuum is released.

It will be appreciated that in order to conduct the electrical testing of the circuit board 1, it is necessary to connect both arrays 2 and 3 to an electrical test equipment. To facilitate this, electrical leads 27 are connected directly to the terminations 26 of the outer ends of the conductive probes forming part of the array 2, and the other ends of such leads 27 are typically connected to the electrical test equipment via an electrical interconnector 35 represented only

diagramatically, but which is mounted on a lower portion of the frame 14. In order to conveniently connect the upper array 3 of electrical probes to the test equipment, the outer terminations 29 are linked by means of conductive wires 30 to a further set of spring-loaded contacts 31 mounted on the bed plate 5,and these co-operate with a similar array of contacts 32 mounted on the lower bed plate 6. Electrical connection between the contacts 31 and 32 is made at the same time as the upper bed plate 5 is drawn down by the suction formed within the chamber 18. Consequently, electrical connections, as represented by leads 34 are made to the lower terminations 33 of the contacts 32 in a manner analogous to the connections made to the terminations 26 by the leads 27. This completely avoids the need to take electrical leads from the upper array 3 out through or over the hinge arrangement and enables all of the electrical connections to be fed to electrical connectors 35 mounted physically adjacent to each other on the lower portion of the frame 14. This further avoids passing wires through a vacuum chamber also eliminating flexing of loose wires. Such connectors 35, of which only one is visible, represent the input/output ports which couple the electrical interface arrangement to the electrical test equipment.

CLAIMS

1. An electrical interface arrangement for coupling a circuit board to electrical test equipment including two arrays of conductive probes which are spaced apart from each other and at least one of which is linked to a movable wall portion of an evacuatable chamber, a reduction in pressure of which serves to move the two arrays towards each other so as to sandwich a circuit board between them; and means for making electrical paths between the electrical test equipment and one array of probes which is associated with one surface of the circuit board by action related to said reduction in pressure.

2. An arrangement as claimed in claim 1 and wherein means are provided for breaking said electrical paths by action related to the restoration of pressure in said chamber during which said arrays move away from each other.

3. An arrangement as claimed in claim 1 or 2 and wherein one array of conductive probes is mounted on a removable wall portion of the chamber.

4. An arrangement as claimed in claim 3 and wherein said one array is mounted on a hinged wall portion with respect to a wall portion on which the other array is mounted so that both arrays are aligned with each other when the hinged wall portion is in a first predetermined position.

5. An arrangement as claimed in claim 1,2,3 or 4 and wherein an input/output port is provided to couple the two

the port being connected to one of said arrays via a set of contacts which make when the two arrays move towards each other, and which break when said reduction in pressure is released.

6. An arrangement as claimed in any of claims 1 to 5 and wherein the two arrays are mounted in a spring loaded fashion on respective bed plates, each plate of which carries means for clamping the circuit boared firmly when the two arrays are drawn towards each other.

7. An arrangement as claimed in claim 6 and wherein the clamping means includes means for co-operating with apertures in the circuit board to ensure that the circuit board is accurately aligned with both of said arrays.

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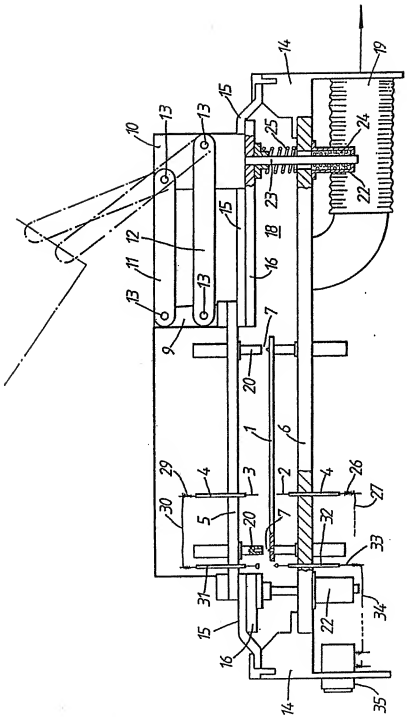
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EUROPEAN SEARCH REPORT

Application number

EP 86 30 0441

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	DE-B-2 657 910 (MARCONI INSTR.) * Figures 1,2 *	1	G 01 R 1/073
A	US-A-2 918 648 (W.W. LUDMAN et al.) * Figure 1 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

G 01 R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10-06-1986	KUSCHBERT D.E.

CATEGORY OF CITED DOCUMENTS

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